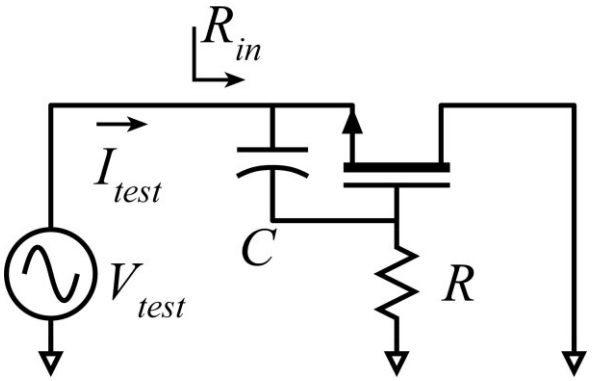
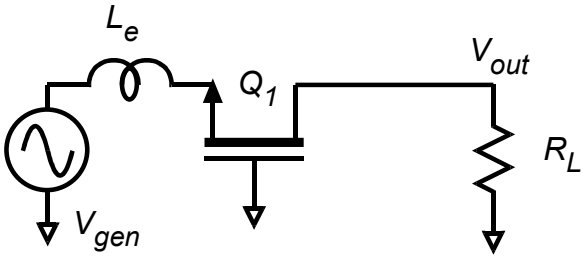
ECE137A Problem set 8



Problem 1: Ignore DC bias analysis. You don't need it. The transistor has transconductance gm. Its output resistance Rds is infinity. (a) Draw a small-signal equivalent circuit of the circuit. (b) using nodal analysis compute Z(s)=Vtest(s)/Itest(s) in ratio-of-polynomials form:

$$Z(s) = Z_{mid-band} \times (s\tau)^m \times \frac{1 + b_1 s + b_2 s^2 + \ldots}{1 + a_1 s + a_2 s^2 + \ldots}$$

here m, an integer, can be positive or negative or zero. (c) g_m =1 mS. R=50 kOhm, C=1pF. Find the frequencies, in Hz, of all the poles and zeros of Zin(s).



Problem 2: Small signal analysis. Ignore the DC bias; you don't need it. The FET has lambda=0 hence Gds=0 (a) Draw an accurate small-signal equivalent circuit model of the circuit Do not show components whose element values are zero or infinity. (c) Using NODAL ANALYSIS, find the transfer function Vout(s)/Vgen(s). The answer must be in standard form

$$\frac{V_{out}(s)}{V_{gen}(s)} = \left.\frac{V_{out}}{V_{gen}}\right|_{DC} \frac{1 + b_1 s + b_2 s^2 + \ldots}{1 + a_1 s + a_2 s^2 + \ldots}$$

(c) gm= 10 mS. RL=1 kOhm. Le= 2 nH Find any/all pole and zero frequencies of the transfer function, in Hz. (d) Draw a clean Bode Plot of Vout/Vin. On the plot, LABEL AXES, LABEL all relevant gains and pole or zero frequencies, Label Slopes. The plot should be drawn on printed semilog paper, and should have axes of Hz, (not rad/sec) and dB. (e) Vin(t) is a 100 mV amplitude step-function. Find Vout(t). Draw a clean graph.